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ABSTRACT

By carefully considering the special characteristics of two small African scientific and technical (S&T) information systems for research and development (R&D), this report defines a simple and straightforward model which can be easily implemented in similar situations with a minimum of external support. The model is designed to build up a local (I&D) competency and to broaden the interface between local R&D activities in Africa and international advances. Following an introduction, the report is divided into five sections: (1) General Problems of Information Provision in Small Systems; (2) The User Community for Science and Technology Information; (3) Science and Technology Information Provision: Present Sources and Organization; (4) Proposals for Strengthening Scientific and Technical Information Provision; and (5) Strategic Issues. A four-item bibliography is included. (THC)

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A MODEL FOR [illegible] AND SYSTEMS IN DEVELOPING COUNTRIES WITH CASE STUDIES IN ETHIOPIA AND TANZANIA

Annette Winkel and Stephan Schwarz

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I. Introduction

Evidently high-level innovative R&D, however small the system, requires high-level information services. Unfortunately, there is a kind of inverse economy of scale, with the effect that, as systems are scaled down, a normal balance between components can no longer be upheld. The viability of very small R&D systems is threatened by several factors, one of which is access to information. There is, therefore, a need to consider very carefully the special characteristics of each small R&D system and to come up with a design meeting the needs within the resources available. It is the purpose of this report to point at a simple and straightforward model which can easily be put into operation with a minimum of external support and which is designed to build up a local I&D competence and widen the interface between the local R&D and the international advances.

II. General problems of information provision in small systems

We will here briefly recapitulate some main issues concerning the problems of small R&D systems (ref. 1). This problematique can only be understood by comparison to the functioning of a well established and stable R&D system. A short list of characteristic conditions might look like this:

a) R&D is pursued in a number of related areas with sufficient range and depth to ensure a multidisciplinary coverage and body of experience.

b) The continuity of effort is granted by a level of personnel throughput, so that capable newcomers can be offered attractive prospects, and for others there are possibilities to opt out to activities outside the R&D system.

c) The system for higher education has a capacity to provide manpower to the different levels of the R&D community and its support.

d) In society there is a sufficiently well-developed infrastructure of technical support for maintenance of R&D equipment.

e) There is an efficient, strongly redundant system for information provision and means of communication, catering for dissemination of results and arguments, the channels being both formal and informal, and supported by computer and telecommunications technology.

It will be observed that failures may occur in any one of these conditions - also in advanced systems - for political, economic or "historical" reasons, causing barriers, instability or decay in development. The problem of the small system is that the components of a stable system cannot be scaled down indefinitely with efficiency unaffected. Even a single research chemist needs access to the basic abstract journals in chemistry - an example of situations where overheads cannot be reduced beyond a limit. As to the R&D environment and the support infrastructure, a reduction of the system will soon cut down essential components below stability, thus disturbing the residual system. These are instances where a partial restructuring and a change of functions is needed to retain control. In small and remote R&D systems characteristic of many LDCs, most of the stabilizing conditions break down and a special design will be necessary.

In the following sections the cases of S&T in Ethiopia and Tanzania will be considered, based on recent experience. It will be observed, that although the systems of higher education are not small, the R&D systems are often "undercritical" in size.

It is not easy to define what constitutes an "R&D project". Here we are assuming that R&D staff have at least a semi-permanent need of advanced R&D literature. This need can serve as a necessary condition to distinguish R&D projects proper from routine applications of standard techniques.

Libraries in LDCs, even more than elsewhere, have suffered severe budget cuts and are often depending on short-term external support. Yet, library holdings of e.g. non-core journals may be strongly underused. To this adds the loose-knit research environment, the lack of a comprehensive support infrastructure, lack of funds to build up and maintain a personal contact network with the international R&D community etc. Some of these problems can be handled by specific functional designs, e.g. the provision of R&D literature. Such designs, however, to be effective have to be combined with strategies to improve the other conditions for stability of R&D systems, a fact often neglected in reports from the I&D perspective.

III. The user community for Science and Technology information

Literature dealing with S&T is produced for many different user groups with widely different background. The more advanced literature requires a more advanced background of previous studies to be adequately selected, understood and applied. Only a very small group can effectively use the large output of R&D journal and monograph literature acquired by academic and other research libraries, whereas a larger group uses textbooks on university level, a still larger group uses textbooks on secondary education level, a still larger group (at least in principle) can use popula[illegible]zation and extension literature. In this context the emphasis is on university-level literature, viz. textbooks, monographs, handbooks and the vast literature presenting actual R&D projects (journals, conf. proceedings and "grey literature"-reports). Any plan for improved information provision has to consider the size and structure of the potential active user community. For research-level literature in S&T this community is very limited in countries like Ethiopia and Tanzania. The user groups concerned are found in University departments (undergraduates, postgraduated and research staff), Research institutes, and other parastatal institutions (like Ministries of Education, Industries and Agriculture), some industries and some international organizations (like the International Livestock Centre for Africa (ILCA)).

In Ethiopia university level education dates back to the early 50's and a unified university organization was established in 1961. The Addis Ababa University (AAU) has

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campuses in different places in Ethiopia, but the Science and Technology faculties are placed in Addis Ababa. From 1974 there was a certain setback for higher education and the research and education situation was normalized only after several years.

The University of Dar Es Salaam in Tanzania was established in 1970 replacing the University College of Dar, a constituent college of the former University of East Africa. The university of Dar includes faculties of Engineering and Science.
As to the size of the university populations in Ethiopia the 1983 total enrollment figures have approached 20.000 in total, about 10% of which may refer to the faculties of Technology and Science, and extensional evening classes in Biology, Chemistry, Mathematics, Physics and Statistics. In Tanzania the University of Dar has a total number of about 3500 full time students, out of whom 570 are enrolled to the faculty of engineering and 470 to the faculty of Science.

In both countries the number of projects is rather limited. This is not surprising when it is born in mind that faculty members have a heavy burden of teaching and of producing textbooks for the undergraduate level. In Ethiopia an estimate of 40-50 ongoing projects within the faculties of Science and Technology seems reasonable and in Tanzania approximately the same number is reported from the faculties of Engineering and Science. The above estimate could be compared with the Ethiopian list of publications for the years 1980-82 which comprises about 70 reports (journal articles and unpublished MSc-theses).

It is difficult to estimate the need of university-level literature outside the universities. In applied research related to S&T, efforts seem to be limited outside the faculties. International organizations operating research programs in Ethiopia, as a rule relate to the agricultural and medical field rather than to Science and Technology. Externally funded research (e.g. SAREC, UNDP) which is administered by the national scientific research councils is to large extent based in University departments.

The Ethiopian Science and Technology Commission (ESTC) and the Tanzanian National Science Research Council (TNSRC), in fulfilling their policy-making an co-ordinating functions, are potential users of the University library system.

IV. SCIENCE AND TECHNOLOGY INFORMATION PROVISION: PRESENT SOURCES AND ORGANIZATION

In both countries the primary sources of Science and Technology information are the university libraries, where the largest collections of relevant scientific documents can be found.

During the last decade many new research libraries have been established in Ethiopia and by now about 50 units are functioning. However, since several of them belong to various ministries and parastatal organizations, coordination for effective resource sharing is difficult. The dominant resource is the AAU library system. It comprises the central (Kennedy) library located in the main campus and twelve specialized branch libraries in and outside the AA area. By bow the total holdings could be estimated to more than 0.5 M volumes.

The AAU libraries have about 240 employees but only 11 are professionals in the sense of holding a BA or MA in library science (or equivalent). About 25 persons have an undergraduate diploma in librarianship.

The AAU libraries' budget appropriated for books and periodicals in 1983 was about 750.000 Birr (= 380.000 US$) (although the conversion into foreign currency is not granted). About 50% go for the S&T libraries' acquisitions.

For the whole library system the number of periodicals titles has gone down in 4-5 years from about 3000 to the present number 1300. Furthermore, a large number of single items or full volumes are missing even from journals subscribed to, due to irregularities in allocation of convertible funds (e.g. in the period 1974-78) and to unreplaced losses. This situation adds to the need of comprehensive and fast external back-up services.

In Tanzania the University Library of Dar es Salaam covers in principle all fields of research and education of the University. The Main Campus Library has a staff of 135 out of which about 25 are librarians and 65 library assistants.

The overall budget of the University Library was for the academic year 1982/83 totally T.Shs. 8.122.000 (= about 0.7 M US$). Out of this amount 100.000 US$ were allocated for books and periodicals. A reduction of about 17% compared to the 1981/82 budget was a result of strict measures applied by the Government. Acquisitions based on normal allocations are dominated by purchase in local book stores since foreign currency cannot be obtained for direct import. In fact no direct orders could be placed with overseas dealers during this period.

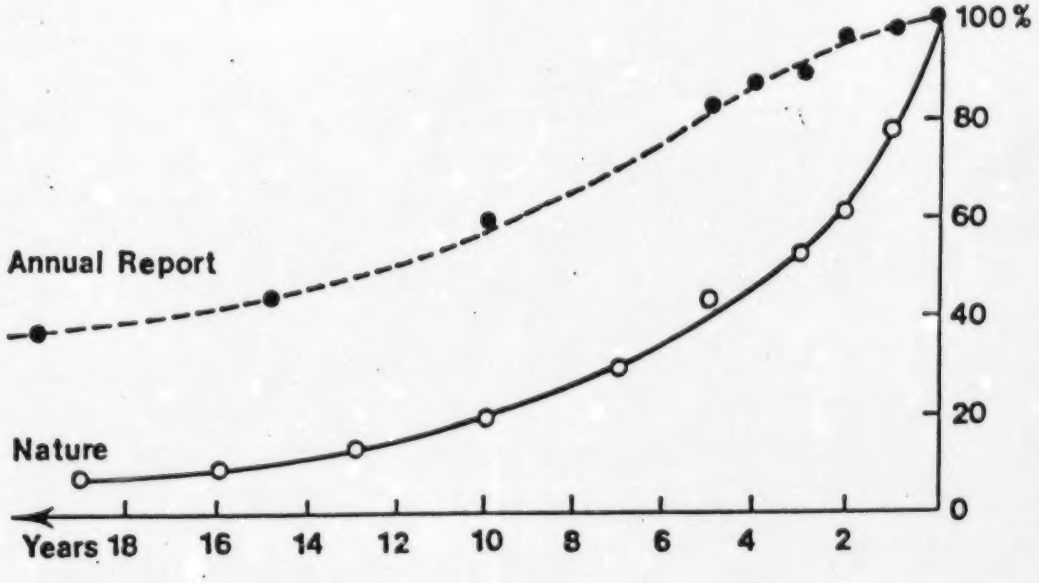
Substantial grants for importation of library materials have however been received from organizations such as NORAD, The British Council, UNESCO and other institutions, worth more than 0.5 M US$. A few periodical titles are acquired on exchange basis.

One type of highly relevant but not easily available literature is journals and other documents (grey literature) from 3rd World countries. Access to part of the bibliographic references to this literature (at least in agriculture and medicine) is possible through international IR-systems, like AGRIS, CAB, Medline, and information services like those of WHO, UNIDO and various international federations iin specialized areas. Within the field of S&T this is generally not effective and contacts in terms of regular exchange between institutions or within "invisible colleges" do not function systematically for information transfer between 3rd World countries ("south-south dialogue"). A large number of proposals have been worked out, inter alia within UNESCO/PGI projects, but so far university and special libraries have not given such programs for systematic build-up of special collections and for offering comprehensive services (nationally or regionally) on such collections a high priority.

In Tanzania the figures for interlibrary exchange with other African countries are low, but the Overseas loans or copy requests (from BLLD) are more than 550 annually.

In Ethiopia likewise interlibrary loans from the AAU to other institutions are not very frequent within S&T, perhaps in the order of 100 a year. Requests from BLLD have to be limited due to shortage of funds (or coupons) for this purpose, which is in reality a setting of priorities in aquisition.

There is one striking indicator for the need of effective support of I&D services to R&D projects. A survey of the age of all references given in the Annual Report (1981) for the department of Chemistry of AAU, when cumulated, gives the following picture (to be seen as an example of a general pattern):



Integrated distribution of reference age in the Annual Report (1981) from the department of Chemistry, AAU. The ordinate for a point on a curve gives the percentage of references older than the abscissa reading. The citations in an issue of Nature have been analysed for comparison.

The top curve gives the percentage of citations (in the AAU material) older than the abscissa reading, while the lower curve corresponds to citations in an issue of Nature. There is in the comparisen an obvious shift from recent references to older ones. A plausible interpretation is the relative difficulty of obtaining recei literature, i.e. that local access is inadequate and that effective backup service from abroad is not offered. It should, however, be noted that som of the research areas concerned may not be fast-moving on the international scene so that the comparison with the "norm" of Nature should be taken with due prudence.

In both countries there are nuclei for I&D centres within the respective research policy bodies (ESTIC, the Ethiopian S&T Information Centre and TANRIS, the Tanzanian Research Information Service). These nuclei can serve as a basis for co-ordinated development of I&D resources and services and as counterpart organization vis-à-vis international contacts.

In Tanzania a number of non-university institutions are using the information service of TANDOC, a documentation centre within the Tanzania Library Service Board. As an excample about 250 institutions are on the mailing list of Industrial Abstracts of Tanzania. The volume of these operations is however modest at present.

V. PROPOSALS FOR STRENGTHENING S&T INFORMATION PROVISION

Bilateral projects for computerized informations retrieval and document back-up

The national information centres, TANRIS and ESTIC, could play a key role in introducing and running a service which gives access to the international literature not locally available. The basic idea of design is, following an inventory of on-going R&D projects, to difine a "profile of research interest" for each project. These "profiles" are sent to an established service abroad for retrospective search and continuing current awareness services. The output (lists of references matching the profiles) are regularly sent to the national information centres for further dissemination to each project group, where

requests for photocopies are generated. These requests can be passed on (e.g. by telex from the centres) and photocopies sent back by air mail. The resulting service actually simulates the working conditions provided by a large library, with a delay of a couple of weeks, which in most cases should be acceptable. The search services could be run by Scandinavian S&T libraries, and the back-up provided by a joint effort of those libraries with supplementary use of BLLD. The document delivery services should respond to any request of published material in S&T, whether derived from citations in the literature or from computer-based bibliographic search. The response rate for this kind of operation will be very high, about 98% of all requests for published material (n.b. for the present user community's needs), i.e. only 2% remain as non-satisfied (undelivered). The grey literature, in particular that of local origin or from the region, which may be highly relevant, has to be dealt with by the local/regional operation of a clearing-house service.

In our opinion this would be a more cost/effective way to solve the demand for articles from not so heavily used journals than to extend the number of subscriptions. Funding for the operations has to be shared between an appropriate foreign funding agency (for the external parts) and the national documentation centre (for the local part).

A similar service has been working for several years in the area of medicine and life sciences by co-operations between the Medical Faculty Library in AAU and KIBIC (the library and information centre at Karolinska Institutet in Stockholm).

Roles of the national I&D centres

An obvious task for the national I&D centres would be to co-ordinate existing and future information services both within the country and in respect to regional and international co-operation. An essential part of such activities will be to:

1. Produce and keep up-to-date an inventory of ongoing R&D research projects, including research staff, within S&T areas.

2. Produce and keep up-to-date a file of research reports within S&T produced in the country (also including reports on locally-based international projects) and to run a clearing-house operation to make this material available.

3. Market the SDI-service and assist in defining and updating the profiles for retrieval.

4. Distribute SDI-printouts and photocopies recieved from the counterpart libraries to local project staff.

5. Channel requests from project staff for photocopies, normally by preparing and transmitting a collective telex request in codified form.

6. Evaluate SDI and back-up service and produce statistics on the most frequently requested journals as an indicator for the University Library acquisition policy.

7. In cooperation with the university libraries and possible international assistance investigate the advantages of microcomputer applications in current administrative processes of library and information services.

VI. STRATEGIC ISSUES

The objectives of creating a satisfactory level of information provision in S&T can be reached successfully only if a stable development is granted for a reasonable time. Apart from a priority given to the local operations by the authorities, what is needed is medium-term funding and an external counterpart organization willing to assume the responsibilities implied. Funding of the external part is to some extent also a question of priorities in the national policy for deployment of contributions for international and bilateral development programs. This is not easy, since there is always competition between different interests, and even if S&T information is given a share, library policies are traditionally more in favour of aquisitions than of alternative services. In setting priorities and policies, it is therefore necessary to analyse the particular small systems problematique in each case, taking into account the different needs, resources and de-

velopment options, where short and medium term perspectives will have to dominate. This is the basic idea of our bilateral operations design, which can easily be adapted so suit different small systems and econonies.

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